The Incidence of the Healthcare Costs of Obesity

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Abstract: The incidence of obesity has increased dramatically in the U.S. in recent years. Obese individuals tend to be sicker and spend more on health care, raising the question of who bears the incidence of obesity-related health care costs. This question is particularly interesting among those with group coverage through an employer, the primary source of coverage for the under 65 population in the U.S., given the lack of explicit risk adjustment of individual health insurance premiums in this market. In this paper, we examine the incidence of the healthcare costs of obesity among full time workers. We find that the incremental healthcare costs associated with obesity are passed on to obese workers with employer-sponsored health insurance in the form of lower cash wages. Obese workers in firms without employer-sponsored insurance do not have a wage offset relative to their non-obese counterparts. Our estimate of the wage offset exceeds estimates of the expected incremental health care costs of these individuals for obese women, but not for men. We find that a substantial part of the lower wages among obese women is attributable to higher health insurance premiums required to cover them.

1.0 Introduction

Obese individuals tend to be sicker and to spend more on health care.[1] Yet, the pricing of employer provided health insurance plans typically does not take the body weight of covered individuals into account[2] even though insurance companies can easily observe body weight from medical claims and screening physical exams.[3] That obese individuals do not pay higher premiums for employer provided insurance, then, is an economic puzzle. Under pooled group health insurance, the insured population at large pays for higher medical expenditures on the obese through higher premiums. Experience rated adjustments to yearly premiums permit insurers to recover increases in costs that are due to changes in the body weight distribution of the pool as a whole. However, employee contributions to plan premiums are rarely risk adjusted (Keenan, Buntin et al., 2001), implying that all individuals within the pool pay for these premiums increases equally. In this case, obese individuals effectively impose a negative externality upon the normal weight individuals in the same plan.

A traditional solution to the related puzzle of why pooling occurs at all in the face of health status information unobserved by health insurance firms is that other features of the employment relationship that are bundled with the offer of health insurance induce unobservably healthy individuals to consent to pooling with the unobservably sick (see Bhattacharya and Vogt, 2004). This explanation cannot rationalize charging *observably* low risk individuals the same premiums as observably high risk individuals. The negative externalities generated by insurance underwriting procedures that ignore body weight yield inefficient outcomes for obese and non-obese alike (see Bhattacharya and Sood, 2004). In models with competitive insurance markets and no unobservable risk information, equilibrium prices never ignore relevant and easily observable data about the insured.

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[1] We include a short review of the literature on the medical costs of obesity below.

[2] There are no legal impediments in any state that we are aware of that prevents insurance companies from charging premiums based upon body weight. Insurance companies providing individual health insurance coverage regularly charge higher premiums to applicants who are observably sicker (such as individuals with preexisting chronic health conditions).

[3] Even if BMI is not currently reported in claims records, it would be a small change to require medical providers to report such information. Most providers already collect weight information during routine office visits, so the costs to providers would be low. Adult height does not change, so collecting such information would impose a one-time cost.

An alternative explanation for the lack of individual variation in premiums for employer-sponsored coverage is that variation in individual expected expenditures is passed on to individual workers in the form of differential wage offsets. If pooling exists at the level of the firm, the wage offset would be identical among covered workers within the firm and would be equal to the average premium. If incidence is specific to the individual, in contrast, variation would exist among workers in the wage offset for health insurance, reflecting differences in individual expected health expenditures.

In this paper, we examine this alternative explanation in the context of the health care costs of obesity. We argue that, though nominal premiums do not depend upon body weight, obese individuals receiving employer provided health insurance pay for their higher medical costs through reduced wages. We generate evidence from the 1989-1999 National Longitudinal Survey of Youth (NLSY) that shows only obese individuals who receive health insurance through their employer pay these costs, not obese individuals who receive health insurance through other sources or are uninsured. Furthermore, using evidence from the linked Medical Expenditure Panel Survey (MEPS) and National Health and Interview Survey (NHIS), we show that the magnitude of the reduced wages corresponds roughly to the difference between obese and non-obese individuals in expected medical care costs. Finally, we show that obese individuals pay no wage costs for other employer-provided fringe benefits, where obesity is not a relevant risk factor in price setting.

The main idea underlying our approach is that the relative wages of obese and non-obese individuals in employment relationships where health insurance is not provided serve as a control for the relative wages of obese and non-obese in employment relationships where health insurance is provided. All else equal, obese individuals with health insurance should receive lower wages relative to their non-obese colleagues, while there should be no difference between the wages of obese and non-obese individuals in jobs without health insurance. Our difference-in-difference approach provides evidence on the validity of two controversial and important points, each of which has generated large literatures.

The first point is that even if employers nominally pay for health insurance premiums, it is really employees who bear the full burden of insurance. In a competitive spot labor market, where wages equal marginal product, increased health insurance costs are passed on to workers directly in the form of lower wages (Rosen, 1986). Empirical evidence of this relationship, however, is difficult to develop because jobs that provide health insurance tend to be good jobs that attract highly productive workers. A direct comparison of the wages of people in jobs with and without health insurance leads to the finding that wages are higher in jobs that offer insurance. Without adequate controls for differences in productivity, not much should be made of such a finding. Our difference-in-difference approach allows us to control for unobserved characteristics of worker-firm matches that affect worker productivity. The evidence we generate provides support for a weaker version of this point—that employees pay for individual characteristics that make them high cost to insure.[4]

The second point is that the lower wages of obese individuals relative to their normal weight peers are due to invidious discrimination against the obese. There is a large literature in labor economics that examines this point and related ones about labor market discrimination based upon physical attractiveness.[5] The most common conclusions reached by papers in this literature are that obese women receive lower wages than non-obese women due to invidious discrimination, but the lower wages of obese men can be explained by differences in job choice and productivity for obese and non-obese men (Pagan and Davila, 1997; Cawley, 2000). The evidence we generate supports a reinterpretation of this literature. We argue that a large part of the wage differences that have been attributed to invidious discrimination against the obese, are in fact due to differences in the costs of providing health insurance for the obese.[6]

2.0 Background

[4] The evidence we develop leaves open the possibility that employers provide subsidies to all employees in an amount that would cover the cost of insuring low risk employees.

[5] See Hamermesh and Biddle (1994) on the returns to beauty in the labor market. Register and William (1990), Pagan and Davila (1997), and Cawley (2000) use the National Longitudinal Survey of Youth (NLSY) to examine wage discrimination related directly to obesity using the NLSY, but do not consider health insurance coverage as an explanation.

[6] Whether our evidence supports a reinterpretation of the literature on discrimination against the physically unattractive more generally depends upon how strongly physical attractiveness is correlated with body weight. To the extent that beauty, in this context, is simply a synonym for not obese, then our evidence calls for a broader reinterpretation of the literature on labor market discrimination against the ugly.

Americans are increasingly overweight or obese. The proportion of adults classified as obese increased from 12.0% in 1991 to 20.9% in 2001 (Mokdad, Serdula et al., 1999; Mokdad, Ford et al., 2003). Because obesity is associated with increased risk of a range of chronic conditions (Sturm, 2002), health care costs are higher for obese than for normal weight individuals. A number of studies look at insured populations working for particular companies or obtaining insurance from a particular source, and all conclude that obese individuals spend more on medical care than normal weight individuals (Burton, Chen et al., 1998; Quesenberry, Caan et al., 1998; Thompson, Brown et al., 2001; Bungam, Satterwhite et al., 2003; Wang, Schultz et al., 2003; Musich, Lu et al., 2004). Finkelstein, et al. (2003), examining evidence from the nationally representative linked National Health Interview Survey (NHIS) and Medical Expenditure Panel Survey (MEPS), estimate that obese individuals with a body mass index[7] (BMI) of 30 or more spend about $732 more than normal weight individuals with a BMI of 25 or less. On an aggregate level, approximately half of the estimated $78.5 billion in medical care spending in 1998 attributable to excess body weight was financed through private insurance (38%) and out-of-pocket payments (14%) (Finkelstein, Flebelkorn et al., 2003).

The role of private insurance in financing obesity-related health care expenditures raises the question of who bears the medical care costs of obesity. Relatively little empirical evidence of any wage offset for health insurance exists with even less information on the extent to which it varies by individual characteristics. This is potentially due to the empirical challenges facing researching in identifying the relationship. The primary issue is that people differ in a number of important but unobserved ways that determine whether they will find jobs that pay high wages and offer health insurance. These often these unobserved determinants of the job match are thus positively correlated with both cash wages and health insurance (Gruber, 2000). Empirical work that ignores this possibility risk incorrectly concluding that workers do not pay for employer-provided health insurance.

The results of early cross sectional studies of the relationship between health insurance premiums or the availability of health insurance and wages for individual workers found a positive relationship, consistent with this type of omitted variables bias (Leibowitz, 1983;

[7] BMI is defined as weight (measured in kilograms) divided by height (measured in meters) squared.

Monheit, Hagan et al., 1985). Even studies adopting more sophisticated methods to account for unobservable worker heterogeneity, including examining the effects of changes in health insurance status on wage changes (Levy and Feldman, 2001) and the effect of mass layoffs on changes in the allocation of compensation between wages and health insurance (Simon, 2001) have not found evidence consistent with the existence of a tradeoff between wages and health insurance. Levy and Feldman attribute their non-findings to a likely correlation between unobserved changes in worker productivity and changes in compensation, including health insurance, while Simon attributes her "wrong-signed" results to heterogeneity among displaced workers in the quality of the match between the worker and the firm in the new job.

The few studies providing evidence of the existence of a wage offset for health insurance provide little information on whether variation among individuals in expected health care expenditures are passed on to individual workers. A study of compensation at the firm level using a structural model provides evidence consistent with wages offsets for fringe benefits including health insurance (Woodbury, 1983). Firm level data, however, do not provide a test of whether variation in the wage offset exists across workers. A study of the adoption of mandated maternity benefits, in contrast, provides evidence that the cost of the mandate fell primarily on workers likely to benefit from the coverage, women of child-bearing age and their husbands (Gruber, 1994). This paper provides the strongest evidence of the existence of individual-specific incidence particularly because in the case of a mandated benefit, we would expect full incidence only if workers fully valued the coverage (Summers, 1989). Other studies suggesting that the incidence of premiums varies across workers include Sheiner (1999) who uses variation in local health care costs as an instrument to identify wage offsets, finding that wages rise more slowly for high risk workers when health care costs rise, and Pauly and Herring (1999) who find that wages rise more slowly with age for workers with health insurance from an employer than uninsured workers.

3.0 Data

We use three different data sources for the empirical work in this paper. We use the National Longitudinal Survey of Youth (NLSY), collected by Bureau of Labor Statistics, for our analysis of worker wages. We use the Medical Expenditure Panel Survey (MEPS), linked to the National Health and Interview Survey (NHIS) for our analysis of obesity and medical expenditures.

3.1 National Longitudinal Survey of Youth

The NLSY is a nationally representative sample of 12,686 people aged 14-22 years in 1979. The survey uses a multi-stage stratified area probability sample of dwelling units and group quarter units and includes an over-sample of Hispanics, Blacks, and economically disadvantaged youth. The survey was conducted annually until 1994, and biennially until 2000. The retention rate was 91.2% of the eligible respondents in 1989 and 84.4% in 1998. Our study uses NLSY data from 1989-1998 for individuals employed full time, which is defined as usually worked 7 or more hours a day at their primary job. We use only post-1988 data because of the inclusion of questions on health insurance status as well as fringe benefits offered by employers such as health insurance, life insurance, dental insurance, maternity/paternity leave, retirement plan, childcare, etc. We omit 1991 from our analyses due to the lack of information on health insurance status for that particular survey year.

The dependent variable in our analysis is the worker's hourly wage. We top and bottom code the wage at $1 and $290 per hour, respectively to correct for errors in coding.[8] The NLSY includes measures of individual weight in each year and height in 1985 for each respondent. We recode this into Body Mass Index (BMI) and use it to derive the categorical indicators of overweight ($30 > \text{BMI} \geq 25$) and obese ($\text{BMI} \geq 30$).[9]

Health insurance status is defined by the NLSY questionnaire as coverage "by any kind of private or government health or hospitalization plans or health maintenance organization (HMO) plans."[10] Health insurance plan sources are identified for those with health insurance as either current employer, other employer (former employer coverage or spouse's current or former employer coverage), individually purchased, public (Medicaid, Medi-Cal, Medical Assistance,

[8] Cawley (2000) follows this same procedure.
[9] These definitions of obesity and overweight are standard in the medical literature (see http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-adult-formula.htm).
[10] The NLSY question on health insurance does not specify any particular time period of coverage, but in the context of the rest of questionnaire, it seems likely that respondents are giving information about their current health insurance coverage.

Welfare, Medical Services), or other source. Survey respondents are able to indicate more than one source of coverage and for those indicating more than one source, we classified them as a single source using a hierarchical method. The hierarchy is employer-sponsored coverage in own name, other source of employer sponsored coverage, individual coverage, public coverage, and finally other coverage.

For our basic models, the sample size is 36,269 person-years. In adjusted models, this reduces to 29,016 due to missing data for our control variables. Tables 1 and 2 present some sample statistics (means and variances over all the observations from 1989 to 1998) describing three different subsets of the NLSY participants. Sample 1 is the set of all workers who worked full time each year between 1989 and 1998. People in this sample earned about $13 per hour, on average; 16.5% were obese; 16.4% were uninsured; 57% were male; and as a group had higher AFQT[11] than a random sample of Americans—35% scored in the top quartile. Most commonly (36% of responses), Sample 1 respondents worked in firms with 50 to 999 employees in the manufacturing (19.7% of responses) and professional and related services (20% of responses) industries. The most common occupations were in the managerial and professional category—26.9% of sample respondents.

Table 3 shows how body weight and health insurance coverage have evolved over time for the individuals in Sample 1. Between 1989 and 1998, obesity rates in this population rose precipitously from 11% to 23% of the sample. This rise in obesity reflects both the aging of the sample, as well as the general increase in American body weight over this period. Over the same period, uninsurance rates dropped by four percentage points for this population.

Sample 2, which is a subset of Sample 1, excludes workers who had health insurance from other sources than their current employer. Sample 2, then includes only full-time workers who received insurance through their employer, and full-time workers who were not insured. It is our main analytical sample. In many ways, this sample looks like the respondents in Sample 1. However, Sample 2 respondents have a slightly higher wage ($13.40 per hour), are more likely to be uninsured (21.2%), more likely male (61%), and more likely to work at larger firms.

[11] AFQT is the Armed Forces Qualifying Test, which is arguably a measure of IQ.

Sample 3, a subset of Sample 2, excludes workers who switched from no insurance to insurance, or vice versa, at any time between 1989 and 1998. It thus consists of full-time workers who were continuously insured or continuously uninsured between 1989 and 1998. We use Sample 3 mainly to conduct some sensitivity tests on our main results.

3.2 Medical Expenditure and Obesity Data

Because the NLSY does not report information on medical expenditures, we use an alternative data source to analyze how well obesity predicts such expenditures. The 1998 Medical Expenditure Panel Survey (MEPS) collects nationally representative data on how much non-institutionalized Americans spend on medical care. The MEPS tabulates expenditures on a comprehensive set of categories including inpatient care, outpatient care, and prescription drugs. These data are the best available medical expenditure data on this broad population because it combines a detailed survey of respondents along with an audit of those responses conducted by consulting the administrative records of health insurance companies, pharmacies, and hospitals. Unlike the Consumer Expenditure Survey, which is conducted by the federal government with the objective of constructing of inflation measures, the MEPS includes expenditures on medical goods that come on behalf of patients by insurance companies, as well as out-of-pocket expenditures.

The sample frame for the MEPS is drawn from the NHIS, which is a nationally representative dataset designed to represent the non-institutionalized population. The NHIS includes self-reported information on both height and body weight.[12] Because the MEPS sample is drawn from the NHIS, it is possible to link the 1998 MEPS to the 1996 and 1997 NHIS data.[13] This linked data set includes nationally representative micro data on weight and medical expenditures, which is what we need to conduct our analysis. People who received health insurance through the Veterans' Administration or through Workers' Compensation programs are excluded from

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[12] Both men and women systematically misreport their weight—see Lakdawalla and Philipson (2002). Heavy men and women tend to under report their weight, while underweight men tend to over report their weight. Lakdawalla and Philipson (2002) find that this misreporting is small enough that it does not affect the qualitative conclusions of their empirical work.

[13] We thank Eric Finkelstein for kindly providing this linked data set for our use.

this linked dataset. Children (under age 18) and pregnant women are also excluded. There are 9,867 adults in the final merged dataset after all the exclusions.

4.0 Empirical Framework

The basic theoretical setting for our analysis is Becker's (1975) model of human capital, modified to permit the provision of health insurance by employers. In a competitive spot labor market where wages form the sum total of compensation to workers, the wages of worker *i* at time *t*, w_{it}, will equal her marginal revenue product, MRP_{it}.[14] In firms that provide health insurance to their employees, this equality between wages and marginal product will be modified in equilibrium by the fact that health insurance provision is costly to firms.[15] Suppose first that health insurance premiums are set so that there is no pooling of risk across employees of different health risk.[16] In this case, premiums charged to the firm for the coverage of worker *i*, say p_{it}, will exactly equal the expected medical costs of coverage, Em_{it}.[17] The equilibrium condition is:

$$(1) \qquad w_{it} = MRP_{it} - p_{it} = MRP_{it} - Em_{it}\,.$$

Equation (1) implies that the worker pays the full cost of health insurance coverage through decreased wages, even though the employer nominally provides the coverage. Suppose instead that people within a firm are charged premiums that pool health risks across the K employees in the firm. In that case, for each employee, employers will be charged the mean premium of insuring each member of the firm: $\frac{1}{K}\sum_k Em_{kt}$. In this second case, the equilibrium condition is:

[14] By focusing on spot labor markets, we are abstracting away issues of investment in job-specific human capital which can also lead to differences between wages and marginal revenue product.

[15] This equality is also modified if the provision of health insurance makes workers more productive. Let MP' be the extra productivity of workers covered by health insurance, and let p represent the costs of insuring a worker. In a competitive spot labor market, w + p = MP + MP'. In this paper, we assume MP' = 0. An empirical justification for this assumption is that in the RAND Health Insurance Experiment (Newhouse, 1996), the marginal health effects of generous first-dollar health insurance coverage over very stingy insurance are small.

[16] We also assume that health insurance markets are actuarially fair, though this assumption could be relaxed to permit fixed loading charges without altering our main points.

[17] We assume for the sake of staying focused on our point that there is no cost sharing in the employer provided health plan.

(2) $$w_{it} = MRP_{it} - \frac{1}{K}\sum_k Em_{kt}$$

Equation (2) implies that all the workers within the firm pay, in part, for the high medical costs of one of the employees. A one dollar increase in medical expenditures for worker *i* will decrease her wages by only $\$ 1/K$. Obviously, under pooling, as the firm size grows large, the marginal costs to any particular worker of higher expected medical costs tend toward zero.

A key conjecture underlying the interpretation of our empirical work is that, all else equal, body weight is not causally related to MRP_{it}. That is, an obese worker and a thin worker, both of whom are the same age, have the same education, same job experience, same native intelligence, working in the same industry, and with the same levels of all other determinants of MRP, will be equally productive. This conjecture is consistent with the best available evidence in the literature. Both Register and William (1990) and Pagan and Davila (1997) find obesity-wage gradients in different years of the NLSY for women, but not for men. Both sets of authors attribute the lower wages of obese women to labor market discrimination, rather than to differences in productivity. Also using the NLSY, but using a different identifying assumption, Cawley (2000) also finds lower wages for obese white women compared with normal weight white women. He does not find the same gradients for men or for black and Hispanic women. He concludes:

> It should be stressed that the finding that weight lowers wages is not conclusive evidence of workplace discrimination. Another hypothesis also consistent with these findings is that heavier workers are less productive at work. It has repeatedly been found, for example, that obese workers are more likely to miss work due to illness. However, this explanation is complicated by the fact that this paper finds no evidence that weight lowers wages for black women. (p.19)

In other words, maintaining the position that obese workers are less productive requires *ad hoc* assumptions about how obesity affects men and women and whites and blacks differently.[18]

[18] The evidence that Cawley cites about the correlation between obesity and sick days makes only a prima facie case that obesity reduces productivity. More evidence establishing that obese workers are equally or less productive, all else equal, on non-sick days is needed to make the case for productivity differences.

The literature we cite in section 2 is convincing on the point that obesity can often lead to higher medical costs. In the framework of this section, this implies Em_i is higher for some obese workers than their thinner colleagues.[19] If the conjecture is correct, our theoretical framework implies that whether obese workers have lower wages will depend upon whether they work at firms that provide health insurance, and whether insurance premiums pool health risks across workers within firms. Thus a finding of no wage differences between the obese and non-obese at firms that provide health insurance would imply pooling and no discrimination against the obese. A finding of wage differences less than expected marginal healthcare costs of obesity would suggest partial pooling or complete pooling and discrimination. A finding of wage differences larger than expected marginal healthcare costs would suggest discrimination as well as no pooling, though pooling and extensive discrimination could not be ruled out. This conjecture is thus closely related to the main argument of this paper—that wage differences between obese and normal weight individuals among those receiving health insurance through their employer reflect differences in the costs of health insurance coverage, rather than labor market discrimination against the obese, or differences in productivity.

One implication of the conjecture is that, considering only workers in jobs that do not provide health insurance, we should find no differences in wages between the obese and non-obese. In fact in Table 4, we show that wage differences in this group are small and statistically insignificant, with obese workers earning more than non-obese workers in some years. Our main empirical strategy is to use these wage differences among the non-insured group as a control for the body-weight wage differences in the insured group. If the conjecture is correct, then the wage differences in the non-insured group represent the effects of discrimination against the obese. We construct a difference-in-difference estimate of the effect of wage offset that obese workers paid for insurance (relative to normal weight workers) in firms that provide insurance, using the body-weight wage differences among the uninsured group as a control for residual discrimination.

[19] In section 5, below, using the best available data, we show that obesity increases medical costs for adult women, but not for men.

It seems plausible that the effects of discrimination should not differ between low end jobs that do not provide insurance and high end jobs that do, though unlike the conjecture we cannot test this point empirically. If these effects do differ, it seems most likely that the effects of discrimination would be greatest in the low end jobs, which would lead us to *underestimate* the marginal costs that the obese employed insured pay for their insurance; that is we would tend to falsely conclude that health premiums are pooled within companies. On the other hand, if the effects of discrimination are smallest in low end jobs, our estimates represent an *overestimate* of the marginal costs that the obese employed insured pay for insurance; we would tend to falsely conclude that health premiums are passed through to employees.

Let HI_{it} indicate whether worker i enrolls[20] in health insurance through her employer in year t, and let O_{it} represent whether worker i is obese in year t. Let X_{it} represent a set of observable covariates that determine either labor market productivity, or expected medical costs of insurance coverage, or both. Let ε_{it} represent a zero mean regression error, assumed uncorrelated with X_{it}, HI_{it}, and O_{it}. If α, β, δ, γ, and λ represent the parameters of the regression, our main empirical specification takes the following form:

$$(3) \qquad w_{it} = \alpha + X_{it}\beta + \delta HI_{it} + \gamma O_{it} + \lambda HI_{it} \cdot O_{it} + \varepsilon_{it}$$

The control variables that we include in X_{it} are the survey year, gender, race (white, black, and other), marital status (never married, married with spouse present, and other), age category (25-29 years, 30-32 years, 33-35 years, and 36-40 years), education level measured by highest grade completed (0-8 years, 9-12 years, and 13 or more years), AFQT score (0-24th percentile, 25th-50th percentile, 51st-75th percentile, 76th-100th percentile), job tenure (less than 48 weeks, 48-143 weeks, 144-287 weeks, and 288 or more weeks), location of residence (urban or rural), number of employees at workplace (less than 10 people, 10-24 people, 25-49 people, 50-999 people, and 1000 or more people), industry category (agriculture; forestry and fisheries; mining; construction; manufacturing; transportation, communications, and other public utilities; wholesale trade; retail trade; finance, insurance and real estate; business and repair services;

[20] In our main results, our employer-provided health insurance coverage variable reflects whether the worker enrolled in the health insurance plan offered by the employer. As a sensitivity check, we also present models that redefine the insurance variable as reflect whether the employer offered health insurance.

personal services; entertainment and recreation services; professional and related services; and public administration), and occupation category (managerial and professional specialty; technical and sales; administrative support; service; farming, forestry, and fishing; precision, production, craft, and repair; operators, fabricators, and laborers; and armed forces).

5.0 Results

Table 4 present the main results for the paper, estimated using Sample 2—all full-time workers except those who received their health insurance from the private market, or from an employer other than their main employer (such as their spouse). Pooling the data from all the NLSY years, the unadjusted difference-in-difference estimate of the incidence of obesity on wages is $1.26, and the estimate is statistically significant at the 1% level. Based on the unadjusted cross-sectional estimates by year, it appears that the wage offset increased over time, which is consistent with the fact that the difference between the medical expenditures of the obese and non-obese increase with age up to age 65.[21] The estimate for 1989 is positive (0.81) and not statistically significant. The direction of the effect changes and becomes larger in magnitude over time. By 1998, the estimate was -$3.79 and statistically significant. Among the insured, the obese earned less than the non-obese in every year of observation, and in most years, the difference exceeded $2 per hour, which represents over 15% of average wages of the insured obese. Among the uninsured, in two of the seven years (including the final year of observation), the obese earned more than the non-obese, and in no year did the wage difference exceed $2. The average wage difference is 43 cents, which represents 4.9% of average wages of the uninsured obese.

In Table 5, Model 1 presents the main results adjusting for a variety of individual characteristics, X_{it}. Though the difference-in-difference estimate of the incidence of obesity on wages declines to $1.04, it remains economically and statistically significant at $p<0.05$.[22] The sample for Model 1 remains all full-time workers in each year of the survey either with health insurance from an employer or uninsured. We use the wage as the dependent variable rather than a logarithmic transformation because we are interested in the magnitude of the effect in dollars. These main

[21] See Finkelstein et al. (2003).
[22] We estimate models using ordinary least squares, applying sample weights and adjusting the standard errors for clustering within individuals.

results from Tables 4 and 5 provide prima facie support for the main argument of our paper—that lower wages of the obese are caused by higher expected medical care costs. These results also suggest that the non-obese in firms that supply health insurance to their workers do not subsidize the medical expenditures of the obese, though our main evidence on whether there is pooling is still to come.

Model 2, also presented in Table 5, is the first of several specification checks that we run to test the robustness of our results. The idea underlying this specification check is that obese workers who receive health insurance from sources other than their own employer should see no wage decline relative to their non-obese colleagues, since obese and non-obese are in different health insurance pools. We expand our sample to include all full-time workers regardless of health insurance status and include both the main effects of different types of coverage (health insurance through another employer, individual coverage, and public coverage) and their interactions with the obesity indicator.

In Model 2, the magnitude of the wage effect of obesity among insured workers declines to -$0.82, and is no longer statistically significant at conventional levels. However, we find that, for workers obtaining coverage through an alternative employer, the point estimate is much smaller (-$0.06) and statistically insignificant, essentially zero. The absence of differential wage offsets for other sources of coverage provides evidence that our results are not driven by an unobserved characteristics correlated with health insurance and obesity. It also suggests that invidious discrimination against the obese may play a limited role in explaining wage differences—why should there be discrimination against the obese only when they enroll in employer-provided health insurance? For those who receive their insurance through the individual health insurance market or through the government, the point estimates of the interaction terms indicate larger negative effects, but once again, they are not statistically significant. A possible explanation for this is that timing of the insurance coverage data may not coincide precisely with the wage question. While the insurance questions are likely to be interpreted as coverage at a point in time, the wage question is “usual hourly wage.”

If individuals move between individual or public coverage and employer-sponsored plans, our estimates may reflect wages when they had employer-sponsored coverage. To address the possibility that such movement is contaminating our results, we estimate Model 3 (also presented in Table 5), where we restrict the sample to survey respondents who were employed full-time continuously during the years we study. In this model, the point estimate of the effect of obesity on wages of the insured remains negative and indicates a sizable effect, although it is no longer statistically significant. However, the sample size is also much smaller in this specification check, with only 14% of the sample uninsured and 2.3% of the sample obese and uninsured, which suggests that our ability to obtain precise estimates is also smaller.

Finally, Model 4 in Table 5 returns to our main sample (Sample 2), which we used to estimate Model 1. In Model 4, however, we include including indicator of both overweight (BMI 25-30) and obesity (BMI 30+) in the regression, along with the interaction of these indicators with employer provided health insurance. In the literature on medical costs of obesity, overweight individuals typically have much lower expenditures than the obese, and often have expenditures that do not differ substantially from normal weight individuals.[23] If the wage offsets we have observed for the obese do reflect increased medical expenditures, the relatively low medical expenditures of the overweight suggests there should be little or no wage offset for overweight in jobs that provide health insurance. The results in Model 4 suggest that this is indeed the case. While the obese in insured jobs earn a statistically and economically significant $1.24 less than normal weight individuals in insured jobs, overweight individuals earn a statistically insignificant 45 cents less. These results provide further support for our story that health expenditures are the obesity wage penalty.

Health insurance is not the only fringe benefit that employers sometimes provide to their employees. Other benefits sometimes offered (which the NLSY asks about) include life insurance, dental insurance, maternity leave, retirement benefits, profit-sharing, vocational training, child care, and flexible hours. Because the value of these benefits, for the most part, does not vary with worker weight, they provide an opportunity to test our empirical

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[23] This is the case in the only nationally representative study of medical expenditures by the obese—Finkelstein et al. (2003).

specification.[24] Obese workers should suffer no extra wage penalty if employers provide these benefits. This test allows us to determine if the results we find for health insurance are driven by omitted factors relating to worker productivity that affect the availability of all types of benefits.

In Table 6, we use the same differences in differences approach we used previously to test the incidence of other types of employer-sponsored benefits on worker wages.[25] The first row shows again the wage penalty for obese individuals due to employer-provided health insurance. This result differs in a subtle but important way from the results presented in Tables 4 and 5. In particular, in Table 6 an employee is counted as insured if she is simply offered insurance by her employer, whether she takes up the insurance or not. In the earlier tables, employees were counted as insured through their employer only if they enrolled in the employer's health insurance plan. In both the adjusted and unadjusted results, there is a large wage penalty for obese individuals, similar in magnitude to the wage penalty reported in Tables 4 and 5, though the penalty is not statistically significant in the adjusted difference-in-difference results. The unadjusted difference-in-difference estimate of the incidence of the health care costs of obesity on wages is -$1.43 and is statistically significant. The adjusted estimate decreases slightly to -$1.34 and is no longer statistically significant. Apparently, measuring health insurance using offers, rather than enrollment does not substantially alter our main results.

The results in the other rows of Table 6 indicate no wage penalty for the obese when employers offer any of the other fringe benefits that we consider, whether we adjust for covariates or not. For all the benefits listed, with the exception of health insurance, the survey does not provide information about whether the worker was enrolled, so we unfortunately cannot check whether the same results hold for enrollment for the other fringe benefit. This provides further support that our results are not driven by omitted variables that affect the availability of many types of

[24] While obese individuals do have shorter life spans than non-obese individuals, these differences are substantially smaller than the differences in medical expenditures. Consequently, life insurance premiums differences are substantially smaller as well.

[25] We estimate these models on the sample of workers employed full-time in each year either with employer-sponsored coverage or uninsured and present both unadjusted and adjusted estimates. The table entries show the coefficients and standard errors from the interaction terms between obesity and fringe benefit offers from employers. Each table entry represents a different regression. Full regression results are available upon request from the authors.

benefits. It is also our strongest evidence that obese and non-obese workers within a firm do not pool health risks, and that wage differences serve as the mechanism by which pooling is undone.

In Table 7, we more closely examine the time trend we observed in the adjusted estimates in Table 1. We present both the adjusted and unadjusted estimates by year. These are produced by estimating the model separately for each year of data. In general, we find that, after adjusting for a range of characteristics, the time trend we observed in the unadjusted model appears to remain. More specifically, the magnitude of the effect is generally larger in more recent years. In the last rows of the table, we test whether the adjusted difference-difference estimate in each year differs from that of 1989 by pooling the data and including the complete set of obesity*insurance status*year interaction terms. We find that in most years, the magnitude of the effect differed from that in 1989, indicating that the offset emerged over time during the years of our study.

These findings on the time trend in the obesity wage penalty suggest at least three explanations. First, the costs of treating obesity may have increased over the time period. Better, but more costly, treatments for the health consequences of obesity may have diffused into standard medical practice during this period, raising the cost of treatment conditional on being obese. In addition, other studies have demonstrated that body weight at the 95th percentile of the weight distribution has increased more rapidly than median body weight, suggesting those classified as obese may be increasingly disabled. Second, the expected medical care costs of obesity may increase with age. Our study is based on a panel of survey respondents, and the average age of individuals in the sample for our study increased from 28.51 in 1989 to 37.54 in 1998. Thus, increases in obesity-related costs with age would explain our findings. And third, the mechanism by which wages adjust may be that the wages of obese workers with health insurance rise more slowly than other workers. This is consistent with the composition of our panel in the sense that they enter the study near the beginning of their working years and are tracked over time.

Next, we examine the implications of our findings for the literature relating obesity to workers wages. When we estimate the model with an indicator of obesity but without the controls for health insurance status (Table 8, Model 1), we find a large, statistically negative significant effect of obesity on wages. Obese workers earn on average $0.82 per hour less than normal or overweight workers. When we add the control for health insurance (Model 2), the effect of obesity on wages is similar to the model without the insurance control. However, when we enter the interaction between obesity and employer-sponsored coverage into the model, the effect of obesity on wages essentially disappears. These finding suggest that, in our sample, a substantial part of the effect of obesity on wages can be explained by the higher costs of providing employer-sponsored health insurance to these individuals.

One important finding of the obesity-wage literature is that it is women, rather than men, who suffer the greatest wage penalty from being obese. Since many of these studies also rely upon the NLSY, it should not surprise the reader that we can replicate these results. Model 1 in Table 9 reports the results from separate regressions for male and female full-time workers in Sample 2 of wage on an indicator of obesity and the control variables contained in X_{it} (defined above). Obese men earn 70 cents per hour less than non-obese men, while obese women earn $1.26 less than non-obese women. Model 2, which includes enrollment in employer-provided health insurance (HI_{it}) as an additional control produces essentially the same results as Model 1. However, the results change considerably in Model 3, which includes in addition an interaction term between obesity and HI_{it}. For women, we find that the wage penalty for obesity is concentrated in firms where employers provide health insurance—a $2.51 penalty. In firms that do not provide health insurance, obese women earn 71 cents more than non-obese women, though the result is not statistically significant. For men, on the other hand, the 70 cent obesity wage penalty above is the same in firms that do and do not provide insurance.

While the results in Table 9 for suggests a rethinking of the conclusion that the obesity wage penalty is due mostly to discrimination, the finding that obese males face a wage penalty whether or not they work in firms where health insurance is offered is potentially damaging for this paper's main argument. However, an important premise of this argument is that obese individuals spend more on health care than do non-obese individuals. While results from the studies we discussed earlier indicate that this is indeed the case, we know of no estimate in the literature from nationally representative data that reports yearly medical expenditures for obese and non-obese separately for men and women. Table 10 reports our calculations from the linked NHIS/MEPS data set, which includes all adult Americans in its sample frame. Obese women spent $1432 more per year on healthcare than did non-obese women. The difference for men was considerably smaller—about $300 per year.

These differences are potentially contaminated by the different age distributions of the obese and non-obese in the population. Table 11 reports regressions of medical care expenditures on an indicator of obesity and age. Even after adjusting for age, obese women spend nearly $1270 more per year than non-obese women on healthcare; obese men spend a statistically insignificant $174 more. Table 11 also reports the results from a similar set of regressions run on the set of individuals whose primary insurance source is private in the MEPS/NHIS data. These individuals are presumably much more like the full-time employed population in our NLSY sample; for example, this privately insured sample excludes people over 65 whose primary health insurance derives from Medicare, as well as people on Medicaid who are often not full time workers. In this restricted population, obese spend a statistically significant $713 more on health care than non-obese women, while obese men spend a statistically and economically insignificant $4 more on health care than non-obese men.

The results in Table 11 provide considerable guidance in interpreting the results of Table 9. In the NLSY, obese women who work full-time and enroll in employer provided health insurance work an average of 2041 hours per year. The yearly income penalty from being obese is $5127 = 2041 * $2.51. To the extent that the obese women in the MEPS/NHIS represent the same population as the NLSY obese women, somewhere between $713 and $1432 of this penalty can actually be attributed to higher expected medical expenditures, rather than discrimination.[26] Men who work full-time and enroll in employer provided health insurance work an average of 2307 hours per year in the NLSY; the implied yearly wage penalty is $69 = 2307 * $0.030. Somewhere between $4 and $297 of this penalty can be attributed to higher medical expenditures, rather than discrimination.

6.0 Conclusions

[26] Another explanation that we cannot rule out is that health insurance markets are imperfectly competitive, so that the extra premiums charged for the extra medical costs of covering the obese are not actuarially fair. To the extent that this is the case, it tends to reduce the role of discrimination as an explanation for these findings.

Our results indicate that obese workers with employer-sponsored health insurance pay for their higher expected medical expenditures through lower cash wages. This conclusion is strengthened by our findings that these types of wage offsets do not exist for obese workers with coverage through an alternative employer, and do not exist for other types of fringe benefits for which the cost to the employer of providing is less likely to be affected by BMI.

Although the existence of a wage offset for health insurance is the standard theoretical prediction from economic models of worker compensation, this finding is noteworthy given the dearth of empirical evidence of the existence of these types of wage offsets. Not only do our findings provide evidence that the wage offset exists, but also provides some insight into the level at which wage offsets occur. We find that the magnitude of the wage offset for employer-sponsored coverage varies by individual characteristics that affect expected medical expenditures, in this case obesity. Furthermore, this offset increases with worker age, as the marginal medical costs of insuring an obese individual increase over time. Assuming that obese workers are not highly concentrated within particular firms, this suggests that the wage offset for health insurance varies across individuals within a firm based on their health risk. Our results imply that having insurance provided through an employer does not guarantee the pooling of health risks across employees.

These results on the incidence of employer-provided health insurance are important in the context of the empirical literature, which has argued that it is difficult for employers to charge employees the costs of proving a particular benefit packages. Several explanations have been advanced for the limited ability of employers to specifically tailor employee-specific compensation packages: non-discrimination rules require that employers offer equivalent benefit packages in order to gain the favorable tax treatment of employer-sponsored coverage; the costs of administering employee-specific compensation packages may be prohibitively high; and employee costs and preferences for coverage may not be observable to employers, introducing problems of preference revelation (Gruber, 2000).

Our evidence is consistent with the first two explanations, but inconsistent with the third. If it is illegal or inherently costly for employers to vary the benefit packages based upon worker characteristics, then in equilibrium, changes in individual wages are the only mechanism by which total compensation can adjust toward marginal value product. On the other hand, employers must observe some information about employee cost of health insurance coverage to permit such wage adjustments to occur at all.

Our findings on incidence of obesity related medical care costs among workers with employer-sponsored coverage have important implications for research on the relationship between obesity and wages. These studies have generally found that obese workers have lower wages and that the wage reductions cannot be explained by variation in worker productivity. The underlying implication is that obese workers face significant labor market discrimination. Our results point to and provide empirical evidence supporting an alternative explanation. For workers in jobs where health insurance is not provided by employers, there is only a small obesity wage penalty. The wage penalty is largest in jobs where health insurance is provided. Hence, the cash wages for obese workers are lower than those for non-obese workers because the cost to employers of providing health insurance for these workers is higher.

In fact, our evidence suggests that for both obese male and obese female workers, the magnitude of the wage penalty exceeds the expected marginal cost of insuring an obese individual. The traditional explanations for the obesity wage penalty can be applied to this excess wage penalty over the expected medical costs of obesity, though it is beyond the scope of this paper to sort them out. These explanations include invidious discrimination against the obese, mainly in the high end jobs that provide health insurance, job sorting of the obese into relatively low wage occupations among the high end jobs, and perhaps even productivity differences between the obese and non-obese in high end but not low end jobs.

Finally, our results have implications in the policy debate over what to do about the obesity crisis. Some have suggested that the right response is a tax on fast food and junk food (Brownell and Horgan, 2003). Whether such a tax is a good idea depends, mainly, upon the extent to which individuals pay fully for the consequences of their decisions about diet and exercise.[27] If there

[27] Other authors, like Cutler et al. (2003), have suggested that self control problems on the part of individuals represent an "internality" that make body weight decisions inefficient. Time-inconsistent individuals do not take

are no externalities in these decisions, then "twinkie" taxes will only distort already optimal decisions. But if employer-provided insurance pools the health risk of the obese and non-obese, it will create an externality that reduces incentives to maintain a normal weight. Our evidence on the incidence of the obesity wage premium suggests that pooling of the obese and non-obese does not occur in the employer-sponsored insurance market; hence the externalities caused by health insurance on decisions about body weight are small.

into account the future health implications of the food choices they make in the current period. Bhattacharya and Lakdawalla (2004) argue that even in the presence of such "internalities," sin taxes such as a "twinkie" tax will not, in general, improve the welfare of obese individuals.

Table 1: Sample Characteristics

	SAMPLE 1			SAMPLE 2			SAMPLE 3		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Wage									
Hourly Wage	54,634	12.946	14.280	37,883	13.429	14.269	21,302	14.624	15.023
Insurance Status									
Uninsured	49,666	0.164	0.370	39,069	0.212	0.409	21,791	0.137	0.344
Current Employer	49,666	0.609	0.488	39,069	0.788	0.409	21,791	0.863	0.344
Other employer	49,666	0.145	0.352	39,069	0.000	0.000	21,791	0.000	0.000
Individual Coverage	49,666	0.046	0.209	39,069	0.000	0.000	21,791	0.000	0.000
Medicaid	49,666	0.019	0.138	39,069	0.000	0.000	21,791	0.000	0.000
Unknown	49,666	0.017	0.128	39,069	0.000	0.000	21,791	0.000	0.000
BMI									
Obesity	47,309	0.165	0.372	37,278	0.167	0.373	21,165	0.174	0.379
Overweight	47,309	0.348	0.476	37,278	0.358	0.479	21,165	0.373	0.484
Other Demographic Variables									
Male	56,507	0.572	0.495	39,069	0.614	0.487	21,791	0.656	0.475
Race: White	56,198	0.840	0.367	38,846	0.832	0.374	21,684	0.851	0.356
Race: Black	56,198	0.133	0.340	38,846	0.140	0.347	21,684	0.125	0.330
Race: Other	56,198	0.027	0.163	38,846	0.028	0.165	21,684	0.024	0.154
Never Married	56,504	0.246	0.430	39,066	0.271	0.444	21,790	0.243	0.429
Currently Married	56,504	0.588	0.492	39,066	0.543	0.498	21,790	0.595	0.491
Formerly Married	56,504	0.167	0.373	39,066	0.186	0.389	21,790	0.162	0.368
Age <29	56,507	0.231	0.421	39,069	0.218	0.413	21,791	0.208	0.406
Age 29-32	56,507	0.295	0.456	39,069	0.287	0.452	21,791	0.282	0.450
Age 33-35	56,507	0.268	0.443	39,069	0.265	0.442	21,791	0.270	0.444
Age 35-41	56,507	0.207	0.405	39,069	0.231	0.421	21,791	0.241	0.428
Education: 0-8 years	56,271	0.021	0.145	38,910	0.022	0.148	21,715	0.018	0.132
Education: 9-12 years	56,271	0.514	0.500	38,910	0.515	0.500	21,715	0.505	0.500
Education: 13 + years	56,271	0.464	0.499	38,910	0.463	0.499	21,715	0.477	0.500
AFQT Quartile 1	54,109	0.142	0.349	37,435	0.145	0.352	21,126	0.122	0.327
AFQT Quartile 2	54,109	0.224	0.417	37,435	0.223	0.417	21,126	0.210	0.407
AFQT Quartile 3	54,109	0.292	0.454	37,435	0.286	0.452	21,126	0.288	0.453
AFQT Quartile 4	54,109	0.342	0.475	37,435	0.345	0.475	21,126	0.380	0.485
Urban resident	55,853	0.767	0.423	38,690	0.768	0.422	21,655	0.754	0.431

Sample 1: Full time workers, 1989-1998

Sample 2: Full time workers with current employer sponsored coverage or no insurance

Sample 3: Continuous full time workers with current employer sponsored coverage or no insurance

Table 2: Sample Characteristics

	SAMPLE 1			SAMPLE 2			SAMPLE 3		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Employment Characteristics									
Job tenure <48 weeks	50,889	0.239	0.426	34,672	0.219	0.413	19,079	0.160	0.367
Job tenure: 48-143 weeks	50,889	0.251	0.433	34,672	0.241	0.428	19,079	0.210	0.407
Job tenure: 144-287 weeks	50,889	0.208	0.406	34,672	0.211	0.408	19,079	0.215	0.411
Job tenure: 288+ weeks	50,889	0.303	0.460	34,672	0.330	0.470	19,079	0.415	0.493
Firm size: 0-9 employees	54,525	0.262	0.440	37,699	0.211	0.408	21,192	0.182	0.386
Firm size: 10-24 employees	54,525	0.140	0.347	37,699	0.135	0.342	21,192	0.126	0.332
Firm size: 25-49 employees	54,525	0.113	0.317	37,699	0.120	0.324	21,192	0.119	0.324
Firm size: 50-999 employees	54,525	0.364	0.481	37,699	0.404	0.491	21,192	0.428	0.495
Firm size: 1000+ employees	54,525	0.120	0.325	37,699	0.130	0.337	21,192	0.145	0.352
Industry Category									
Agriculture	50,487	0.024	0.152	34,169	0.021	0.144	18,531	0.020	0.141
Forestry	50,487	0.001	0.034	34,169	0.001	0.034	18,531	0.001	0.036
Mining	50,487	0.007	0.084	34,169	0.008	0.088	18,531	0.008	0.091
Construction	50,487	0.087	0.282	34,169	0.080	0.271	18,531	0.077	0.267
Manufacturing	50,487	0.197	0.398	34,169	0.220	0.414	18,531	0.250	0.433
Transportation	50,487	0.075	0.264	34,169	0.083	0.276	18,531	0.087	0.281
Wholesale trade	50,487	0.033	0.179	34,169	0.032	0.175	18,531	0.034	0.182
Retail trade	50,487	0.131	0.337	34,169	0.123	0.329	18,531	0.100	0.300
Finance	50,487	0.067	0.250	34,169	0.068	0.252	18,531	0.071	0.256
Insurance and Real Estate	50,487	0.035	0.184	34,169	0.026	0.159	18,531	0.015	0.123
Business and Repair Services	50,487	0.078	0.268	34,169	0.075	0.263	18,531	0.071	0.256
Entertainment and Recreation Services	50,487	0.013	0.114	34,169	0.011	0.106	18,531	0.010	0.098
Professional and Related Services	50,487	0.200	0.400	34,169	0.192	0.394	18,531	0.185	0.388
Public Administration	50,487	0.052	0.222	34,169	0.061	0.239	18,531	0.071	0.256
Occupation Category									
Managerial and professional	52,540	0.269	0.444	35,883	0.274	0.446	19,744	0.295	0.456
Technical and sales	52,540	0.135	0.341	35,883	0.131	0.337	19,744	0.130	0.337
Administrative support	52,540	0.151	0.358	35,883	0.149	0.356	19,744	0.150	0.357
Service	52,540	0.118	0.323	35,883	0.106	0.308	19,744	0.079	0.270
Farming, forest, and fishery	52,540	0.024	0.152	35,883	0.020	0.140	19,744	0.019	0.136
Precision production, craft and repair	52,540	0.134	0.340	35,883	0.140	0.347	19,744	0.151	0.358
Operator, fabricators, and laborers	52,540	0.169	0.375	35,883	0.180	0.384	19,744	0.175	0.380
Armed forces	52,540	0.001	0.025	35,883	0.001	0.028	19,744	0.001	0.027

Table 3: Changes in Insurance and Overweight Over Time

	1989	1990	1992	1993	1994	1996	1998
Overweight	0.30	0.32	0.34	0.35	0.36	0.38	0.38
Obese	0.11	0.13	0.15	0.16	0.18	0.20	0.23
Uninsured	0.18	0.16	0.18	0.18	0.16	0.15	0.14
Mean age	28.53	29.52	31.56	32.51	33.51	35.54	37.56
Minimum age	25	26	28	29	30	32	34
Maximum age	32	33	35	36	37	39	41

Table 4: Unadjusted Difference in Difference Estimates of the Hourly Wage Offset for Health Insurance

		All Years	By Year						
			1989	1990	1992	1993	1994	1996	1998
Insured	Obese	13.164	10.764	10.355	12.305	12.370	12.938	14.270	15.976
	Non-obese	14.857	11.906	12.794	13.617	14.879	15.190	16.979	19.373
	Obese-non-obese	-1.694	-1.142	-2.439	-1.313	-2.509	-2.253	-2.709	-3.397
Uninsured	Obese	8.785	6.193	6.990	9.663	7.969	8.755	9.775	10.566
	Non-obese	9.218	8.142	8.764	9.106	8.636	9.995	10.211	10.177
	Obese-non-obese	-0.433	-1.949	-1.774	0.557	-0.667	-1.240	-0.436	0.389
Diff(Insured)-Diff(Uninsured)		-1.261	0.807	-0.665	-1.869	-1.842	-1.013	-2.273	-3.785
		(2.20)**	(0.83)	(0.70)	(0.77)	(2.93)***	(1.08)	(2.56)**	(3.32)***

*** p<0.01, ** p<0.05, * p<0.1. t-stats are listed in parentheses.

Table 5: Adjusted difference-in-difference estimates and specification checks

	Model			
	[1]	**[2]**	**[3]**	**[4]**
Obese	-0.038	-0.231	-0.776	0.015
	(0.07)	(0.43)	(1.30)	(0.03)
Current employer sponsored coverage	2.490	2.315	2.238	2.688
	(9.16)***	(8.12)***	(4.86)***	(8.43)***
Obese * employer sponsored insurance	-1.043	-0.822	-0.688	-1.243
	(1.70)*	(1.39)	(1.01)	(1.97)**
Overweight				0.137
				(0.30)
Overweight * employer sponsored insurance				-0.455
				(0.86)
Insurance through spouse or other employers		0.487		
		(1.19)		
Obese * Insurance through spouse or other employers		-0.055		
		(0.07)		
Individual Insurance		2.119		
		(3.54)***		
Obese * Individual Insurance		-0.708		
		(0.60)		
Medicaid		0.110		
		(0.10)		
Obese * Medicaid		-1.456		
		(1.11)		
Constant	7.269	7.567	8.468	7.184
	(4.86)***	(4.94)***	(4.81)***	(4.85)***
Observations	29016	36809	16437	29016
R-squared	0.10	0.10	0.11	0.10

*** p<0.01, ** p<0.05, * p<0.1. t-stats are listed in parentheses.

Note: All models include full set of control variables. Standard errors adjusted for clustering within individual

Model 1: Fulltime workers either with employer-sponsored coverage or uninsured
Model 2: Fulltime workers with any source of coverage
Model 3: Continuously employed fulltime workers either with employer-sponsored coverage or uninsured
Model 4: Indicators of overweight and obese

Table 6: Difference in difference estimates: Effect of other benefits on wages

	Unadjusted			Adjusted		
Fringe	n	Coefficient	T-Stat	n	Coefficient	T-Stat
health	35008	-1.428	1.94*	27970	-1.335	1.53
life	34614	-0.028	0.06	27649	0.072	0.16
dental	34903	-0.483	0.99	27879	-0.703	1.43
maternity	32705	-0.293	0.51	25990	-0.757	1.19
retirement	34489	-0.12	0.23	27537	-0.282	0.52
profit sharing	34615	-0.676	1.16	27649	-0.702	1.2
training/education	34482	-0.47	0.98	27561	-0.409	0.84
childcare	34261	0.763	0.54	27365	1.372	0.83
flex hours	34976	-0.611	1.24	27947	-0.444	0.86

*** $p<0.01$, ** $p<0.05$, * $p<0.1$. t-stats are listed in parentheses.

Note: Standard errors adjusted for clustering within individual.

Sample: Full time workers with employer-sponsored health insurance or uninsured (Sample 3)

Unadjusted regression includes only obese, insurance, and their interaction.

Adjusted Regression includes obese, insurance, obese*insurance, individual characteristics and year dummies

Standard errors are adjusted for clustering at the person level

Report the coefficient on the obesity*insurance interaction term, the t-stat and the stat sig

Table 7: Regression Results by Year

	1989	1990	1992	1993	1994	1996	1998
Unadjusted Estimates by Year	0.807	-0.665	-1.869	-1.842	-1.013	-2.273	-3.785
	(0.83)	(0.70)	(0.77)	(2.93)**	(1.08)	(2.56)*	(3.32)**
Adjusted Estimates by Year	1.273	-0.836	-1.597	-1.936	-0.999	-1.451	-2.354
	(1.25)	(1.27)	(0.60)	(2.95)**	(0.66)	(1.30)	(1.96)*
Adjusted Estimates - Years Pooled#	1.874	-0.458	-1.464	-1.828	-1.173	-1.477	-3.201
	(1.77)	(1.96)*	(1.17)	(3.09)**	(1.70)	(2.17)*	(3.24)**

t-statistic and statistical significance refer to a test of whether the interaction effect for a particular year differs from 1989

Note: Standard errors adjusted for clustering within individual

Sample: Fulltime workers either with employer-sponsored coverage or uninsured

Table 8: The Effect of Obesity on Wages

	Model 1	Model 2	Model 3
Obese	-0.817	-0.851	-0.038
	(3.09)***	(3.23)***	(0.07)
Current employer coverage		2.313	2.490
		(8.86)***	(9.16)***
Obese*Employer coverage			-1.043
			(1.70)*

Note: All models include full set of control variables. Standard errors adjusted for clustering within individual. t-stats are listed in parentheses.

Model 1: Obese with controls

Model 2: Obese & Insurance Status with controls

Model 3: Obese, Insurance Status & Interaction with controls

Table 9: Effect of Obesity on the Wages of Men and Women

	Men			Women		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Obese	-0.695	-0.749	-0.726	-1.256	-1.249	0.716
	(1.97)**	(2.14)**	(1.56)	(3.23)***	(3.21)***	(0.59)
Current employer coverage		2.496	2.501		1.919	2.386
		(7.54)***	(6.77)***		(4.46)***	(6.66)***
Obese*Employer coverage			-0.030			-2.512
			(0.05)			(2.05)**

Note: All models include full set of control variables. Standard errors adjusted for clustering within individual. t-stats are listed in parentheses.
Model 1: Obese with controls
Model 2: Obese & Insurance Status with controls
Model 3: Obese, Insurance Status & Interaction with controls

Table 10: Obesity and Mean Health Care Expenditures—Adult Men and Women

	obese	not obese	Difference
female	$3,985	$2,553	$1,432
male	$2,376	$2,079	$297

Source: Authors’ calculations using the linked MEPS/NHIS datasets

Table 11: Age Adjusted Effect of Obesity on Medical Expenditures—Adult Men and Women

	All Adults		Privately Insured	
	female	male	female	male
obese	1268***	174	713***	4
	(285)	(268)	(256)	(275)
age	108***	94***	67***	73***
	(7)	(6)	(9)	(10)
constant	-2710***	-2274***	-1077***	-1647***
	(359)	(324)	(408)	(414)
N	3795	3282	1880	1797
R^2	0.07	0.06	0.03	0.03

Source: Authors' calculations using the linked MEPS/NHIS datasets
Note: Standard errors are noted in parentheses below the coefficient estimates.
*** p<0.01, ** p<0.05, * p<0.1

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